

Segmentation Activities

In early 2003, NASA completed development of a Segmentation Plan for the removal of reactor internal components and subsequent dismantling of the reactor tank. The Plan described a seven-phase, comprehensive approach to segmentation; beginning with began with “Phase 0” – a setup phase to ensure that the reactor quadrants and canals were adequately prepared for work to proceed. During this phase, tools and materials that workers would need were all “pre-staged” and placed in ready reach before work began. Steel cask liners were put in place to ensure the safe packaging and eventual transport of waste materials to designated disposal and reprocessing locations.

This substantial prep work was accompanied by a similar amount of “mock-up” training, with crews from subcontractor Wachs Technical Services, Inc. utilizing specially designed tools and working on specially designed components that replicated the reactor, as well as actually working on the Mock-up Reactor (MUR) that also formerly operated at Plum Brook Station. The MUR was a smaller, physical replica of the test reactor, with about 95% of its assembly – including the reactor internals – identical to the larger unit. The MUR used much smaller amounts of nuclear fuel than did the test reactor when both were operational, so it provided Wachs workers with an opportunity to train in virtually a “no dose” environment. During this highly successful training, the crew actually disassembled much of the MUR, finishing the job in November 2003.

Phase 1 of segmentation began in August 2003 and involved safely and successfully removing three components known as Horizontal Beam Tubes. These tubes had been used for experiments when the reactor was operational. Because they contained a significant portion of the radioactive material within the Reactor Facility, NASA made their removal the first order of business during segmentation. Workers removed the tubes in the manner they had practiced – remotely – while looking into camera monitors to minimize exposure. They used a special air-activated table device to guide the tubes out of the side of the reactor and into one of the quadrants of the Reactor Facility. There, workers used a specially designed, remotely operated band saw to cut through the tubes, after which an overhead crane lifted the cut pieces out of the quadrant and into a steel liner.

Workers inserted a stainless steel plug into the hole in the reactor wall and made use of a special Cask Transfer System (involving the large capacity crane and a cart mounted on trolley-like tracks) to move the external ends of the Horizontal Beam Tubes into a dedicated area of the Reactor Facility, where they underwent further size reduction and temporary storage in a liner. The filled and sealed liners were then placed in a specialized shipping cask that was sealed for transport. NASA put the cask on a truck on September 3 and shipped it to the Barnwell licensed disposal facility in South Carolina, where it arrived safely the next day. Wachs also began work on Phase 1A of segmentation in August, removing reactor internals above the core region, including the components known as Horizontal Through Tubes, and later the reactor pressure vessel head, making it easier to cut and remove more reactor internals.

Phase 2 of segmentation started last fall, as workers began the removing internals, including steel control rods, from the core region of the reactor. They initially removed components with low levels of contamination, before taking out highly irradiated components, known as control rods, from the reactor vessel. The control rods were used to govern the reactor's power when it was operational. They were lifted by crane from the reactor tank into a stainless steel cask liner; then the liner was placed in a "transfer" cask which consists of two inches of steel, over six inches of lead, over another two inches of steel. Workers used the Canal Transfer System to move the packaged control rods into a designated area of the Hot Lab Building Reactor Facility for safe, interim storage, and to await the arrival of a special cask for shipping the more irradiated components. They will eventually be placed in the cask and sent by truck to the Barnwell disposal facility.

Work on Phase 2 continued into 2004 when, in February, workers removed a beryllium reflector plate, and later, the core box (to which another plate was attached) from the reactor tank. When the reactor was operational, the beryllium plates reflected neutrons back into the reactor. The core box was where the nuclear fuel was actually contained. After removing the intact plate, workers placed it in a steel liner, to which they added an epoxy-like substance to stabilize the plate. The other plate and the attached core box were moved to a cutting station in the Containment Vessel, where the core box was segmented; then the core pieces and the beryllium plate were moved into liners and immobilized. The filled liners were moved an interim storage area for subsequent shipment to Barnwell. Workers later completed removing the control rods, thus safely completing the disassembly and packaging of the reactor internals with the highest amounts of radiation.

Workers have since moved on Phase 3 of segmentation, removing reactor internals located below the core region of the tank. After this phase is completed, two will remain. In Phase 4, workers will segment the reactor tank and in Phase 5, will undertake demobilization. NASA anticipates that all segmentation work will be complete by the end of this summer.